BWD

540

DC to 100MHz Dual Trace Field Portable Oscilloscope

Features

Vertical:
5mV to 20V/Div. Sensitivity.
DC to 100MHz — 3db.
x5 gain channel 1 DC to 30MHz — 3db.

Time Base:
5 nano Sec to 5 Sec/div. Main Sweep.
5 nano Sec to 1Sec/div. Delayed Sweep.

Trigger:
DC to > 100MHz. Main Time Base
Variable trigger hold off.
Delayed Sweep or Trigger and Mixed Displays.

Horizontal:
Identical X — Y Operation.
5mV to 50V/Div. Sensitivity.
DC to 2MHz.
< 2° Phase Shift from DC to 500kHz.

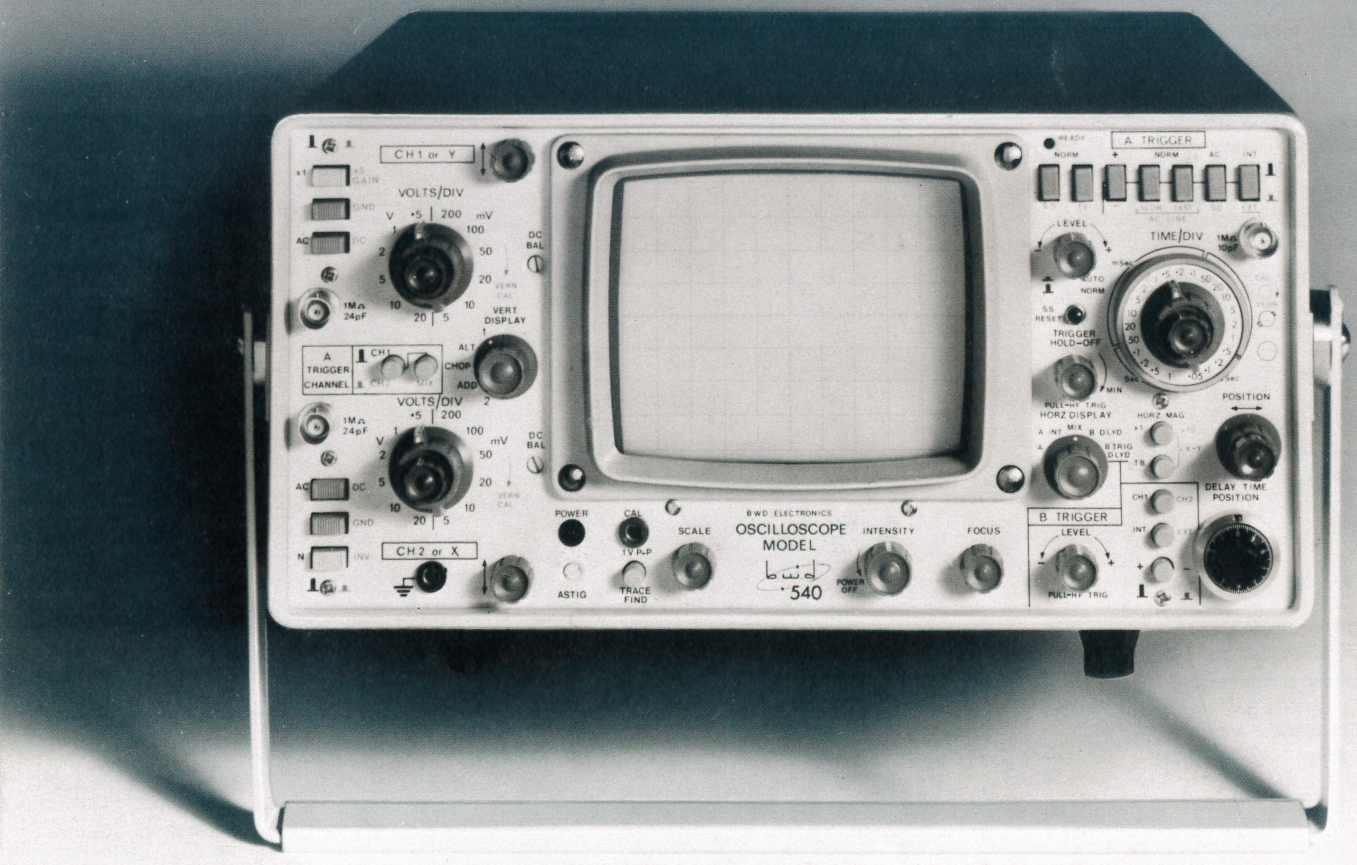
Crt:
8 x 10 cm display.
EHT: 12KV

Stabilised DC — DC converter Power Supply. AC and DC operation.
Battery Pack Option.

Description

The bwd 540 dual channel 100MHz oscilloscope provides the high performance and accuracy required in laboratory applications with light weight field portability. Operation is available from AC or DC power or an optional rechargeable battery pack.
The amplifier rise time of 4n Sec is well suited to all forms of logic circuitry from DTL to ECL.
The main sweep trigger extends from DC to > 100MHz with variable hold off to greater than one sweep length.
This provides the capability to trigger on complex digital signals and virtually any waveform within the vertical amplifiers range including TV line and frame.

The delayed time base has its own trigger source switching, level and polarity selection.
For full digital compatibility the Z modulation is DC coupled and requires only +2V for full blanking.
Although the facilities are comprehensive, operational simplicity is ensured by logical control, layout and marking and the bwd 'All Buttons Out' feature for normal operation.



BWD Oscilloscopes — made to measure

Specification

Vertical System:

From 5mV to 2V/div each vertical amplifier has a DC to 100MHz bandwidth. Channel 1 also has an additional x5 gain switch to increase its sensitivity to 1mV/div with a DC to 30MHz bandwidth.

This retains the dual trace facility which is completely lost when increased sensitivity is otherwise provided by cascading the amplifiers via a patching cable.

All attenuator switching precedes the amplifier input eliminating trace movement associated with gain switching within the amplifier.

Channel 2 incorporates an Invert-switch for applications where signal measurement or comparison is more readily made by inverting the display. It is also used in the ADD mode where inversion of one channel converts the oscilloscope amplifiers from dual channel to a single channel differential input.

An output signal is available from Ch. 1 and may be used to drive external equipment or it may be cascaded into Ch. 2 to increase gain to a max. of 500 μV/div.

Identical X—Y operation is available from 5mV to 50V/div sensitivity. To give this facility a far greater degree of usefulness than is normally accorded to it, phase shift is reduced to < 2° from DC to 500kHz.

Bandwidth: (5mV to 2V/div) DC to 100MHz—3db referred to 6 div. deflection at 50kHz from 25Ω source with vernier to Cal position. 1 div. = 1 cm. In ADD mode bandwidth is DC to 100MHz—6db. (5V to 20V/div.) DC to > 25MHz—3db referred to 8 div. defl. at 50kHz. AC coupling < 2Hz—3db or 0.2Hz with 10:1 probe in use.

Bandwidth: Channel 1 only at x5 gain, DC to 30MHz—3db. AC coupling 2Hz—3db.

Rise Time: 4n Sec < 10nsec at x5 gain & atten steps from 5 to 20V/div. taken between 10% & 90% points on a 6 div. input.

Sensitivity: (both channels) 5mV to 20V/div. in 12 calibrated steps (1—2—5 sequence) Channel 1 only x5 gain 1mV to 4V/div.

Calibration Accuracy: Within 3% at switch settings with Vernier to cal. (5% at x5 gain). Uncalibrated Vernier continuously variable between steps, extends range to 50V/div.

Input R & C: 1MΩ within 2% and 26pf within 2pf.

Max. Input Voltage: 500V (DC + Peak AC) AC component 500V p-p maximum 1kHz or less.

Min. Undistorted Deflection:
8 div. at 75MHz
5.5. div. at 100MHz

Display Modes: Chan. 1, Chan. 2, Alt, Chop, Add.

Chopping Frequency: Approximately 500kHz.

Delay Line: Permits viewing of leading edge of displayed waveform.

Trace Inversion: Push-push switch enables Channel 2 to be inverted for display convenience or when the two amplifiers are used in the ADD mode to provide a differential input facility.

CMRR (in ADD Mode): At least 20db from DC to 20MHz. Common mode signal amplitude < 8 div. with one vernier adjusted for optimum rejection.

Noise: (Tangentially measured) Full bandwidth all sensitivities 0.05 division. x5 gain Channel 1 only < 0.2 div. all sensitivities.

Channel 2 as X Amplifier in X—Y Mode:
Bandwidth: DC to 2.0MHz from 5mV to 50V/div. referred to 6 div. defl.
Phase Shift: < 2° from DC to 500kHz.

Signal Output:
Channel 1 signal is available at a rear panel socket.
Output is DC to 25MHz—3db and approx. 25mV/div. into 50Ω or 50mV/div. into 1MΩ.

Cascade single channel operation:
Ch 1 output may be coupled into Ch 2 to increase gain to over 500μV/div. Noise is approx. 200μV p-p. Bandwidth is 2Hz to approx. 20MHz—3db.

Probes:
The probes provided incorporate a 3 position slide switch for 1:1, 10:1 and REF off position.

The bandwidth in the 10:1 position is DC to 100MHz—3db. Pulse response exhibits approximately 8% overshoot with a 1 nano Sec rise time input. Input C and R is 11pf and 10MΩ.
The bandwidth in the 1:1 position is limited to approximately 20MHz. Input C and R is 66pf and 1MΩ.
Each is supplied with a detachable sprung hook tip, an insulating tip, a BNC Adaptor an I.C. Tip and a Trimmer Tool.

Probe Optional Extras:
TYPE P33 Probe DC — 200MHz. This probe has 1:1 and 10:1 detachable heads. Input C and R is 13pf and 10MΩ. It is supplied with snap together connectors at both ends of the cable and a range of accessories.

TYPE P34 Demodulator Probe.
DC – 200MHz accuracy ± 0.5 db and ± 1 db up to 300MHz. It is supplied with a range of accessories.

Horizontal System:

The main and delayed time bases sweep from 5nSec/div. to 5Sec/div. (Main) and 5nSec/div. to 1Sec/div.(Delayed).

The wide range versatile trigger circuits locks the main time base from DC to 125MHz and the delayed time base from DC to 100MHz. Independent source, polarity and level selection are provided for the delayed T.B. Internal trigger take off for both time bases is ahead of position controls to ensure stable DC coupled triggering irrespective of the trace position.

As this also applies to the mixed trigger facility, stable triggering is obtained when two signals are present irrespective of their position on the screen. Trigger coupling not only includes high, low and power line frequency selection but TV video also with line or frame lock. Single sweep lock out is provided with an LED ready indicator which indicates trace readiness prior to triggering in all sweep modes.

Time Base 'A' (Main or Delaying)
Sweep Rate: 50nSec to 1 Sec/div. in 23 steps of 1—2—5—10 sequence. Max. sweep speed is 5nSec/div. at x10 magnification.
A vernier control covers range between each step and extends range to > 5sec/ div.

Note: Vernier is operative on 'A' TB only when 'A' is selected. It is operative on 'B' TB in the intensified, mixed and delayed modes.

Sweep Accuracy: measured over centre 8 div. of CRT.

x1 Magnification	
+15 to +35°C	0—50°C
3%	5%

x10 Magnification (excluding first 20nSec of display).	
+15 to +35°C	0—50°C
5%	6%

Calibrated Sweep Delay:
Delay Time Range: As Sweep Rate above.
Delay Time Accuracy: 3% over calibrated range.
Delay Multiplier: 0.5 to 10X Time/Div. setting.
Delay Jitter: 1 in 20,000 of maximum delay time.(0.005%)
Multiplier Linearity: < 1% of full scale.

'A' Time Base Sweep Modes:
Mode: Auto (with level select) Non-Auto or Single Sweep with reset button and ready lamp. Ready lamp indicates trace readiness prior to commencement of sweep in all operating modes. Trace free runs in Auto with no trigger signal.

Time Base 'A' Trigger:
Source: Int. Chan 1 or 2, or mixed displays, Ext x 1 or Line frequency.
Coupling: AC or DC, Slow, Fast, TV Line TV frame (also operates as a detector for modulated RF waveforms).
Slope: + or — with level select over 8 div. internal or 5V p-p external.
Sensitivity: Internal
0.3 div. defl. DC to > 25MHz increasing to 1 div. defl. at 100MHz in HF trigger mode.
Signal level requirement increases by x2 in CHOP mode & x5 in Ch 1 x5 gain .
Sensitivity: External
200mV p-p DC to 25MHz increasing to 500mV at 50MHz in gated trigger mode. 200mV p-p at 100MHz in HF trigger mode.
Max. trigger level control 5V p-p (50V p-p with 10:1 probe).
Signal level increases by 2 in chop mode.
External Input Impedance:
1MΩ & 10pf.
Max. Input Voltage: 500V (DC + Peak AC) AC component 500V p-p maximum.
Video Trigger: < 2 div. of composite waveform to over full screen deflection for line or frame lock.
Trigger Hold Off: Continuously variable. To greater than the selected sweep period above 10mSec/div.

'B' Time Base (delayed)
Sweep Base: 50nSec. to 0.2Sec/div. in 21 steps of 1—2—5—10 sequence. An uncalibrated Vernier covers range between steps and extends range to at least 1 Sec/div.

Sweep Accuracy: measured over centre 8 div. of CRT.

x1 Magnification	
+15 to + 35°C	0—50°C
3%	5%

x10 Magnification (excluding first 20nSec of display)	
+15 to +35°C	0—50°C
5%	6%

Time Base 'B' Trigger:
Source: Int. Chan 1 or 2 or Ext.
Coupling: Int & Ext, DC coupled.
Slope: + or — with level select over 8 div. internal or 2V p-p Ext.
Sensitivity: Int. 1 div. 10Hz to 20MHz. 2 div. extends range from DC to 40MHz.
H.F. trigger increases to 70MHz for 1 div. and 100MHz for 2 div. deflection in H.F. trigger mode.
Ext. 200mV p-p 10Hz to 25MHz 500mV p-p DC to 40MHz.
H.F. trigger increases to 100MHz for 200mV p-p input in H.F. trigger mode.

Mixed Sweep:
Accuracy: Identical to A & B sweep accuracy excluding 0.5 div. of start of main sweep and 0.2 div. or 0.1μSec. (whichever is greater) either side of transition from main to delayed sweep.
NOTE: Transition from A to B sweep is delayed compared to the Time/Div. × multiplier setting until B time base reaches the same voltage as A time base and takes over the display.
Mag.: x1 or x10 Horizontal position control fitted with fine and coarse adjustment.
Max Sweep Speed: 5nSec/div.

Output Waveform: 4mm sockets located on rear of 540
(1) Displayed Time Base +1V to +13V 10K source impedance.
(2) A Time Base gate +0.2V to 4V 1kΩ source impedance.
(3) B Time Base gate +0.2V to +4V 1kΩ source impedance.

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General Details

CRT:	80mm x 100mm rectangular, high beam current gun with mesh PDA.
EHT:	12kV.
Graticule:	Internal parallax free with variable illumination. Fitted light blue filter for P31 or amber for P7.
Phosphor:	Normally fitted with P31, P7 available as Option 04.
Z Modulation:	2V positive will blank trace at all intensities from DC to >10MHz. Input impedance 4.7kΩ and 10pf. Max input ± 30V p-p.
Trace Find:	Push button returns trace to within limits of CRT screen and over rules intensity setting.
Calibrator:	Output, rectangular, positive going from ground, 1kHz frequency approx.
Voltage:	1V p-p.
Accuracy:	1% +15 to +35°C, 2% 0 to 50°C.
Output Waveform:	4mm sockets located on rear of bwd 540. (1) Displayed Time Base +1V to 13V 10 kΩ source impedance. (2) A Time Base gate +0.2V to +4V 1kΩ source impedance. (3) B Time Base gate +0.2V to +4V 1kΩ source impedance.
Power Requirements:	AC. 98 to 135V and 195 to 270V. Selection by changeover switch 48 to 440Hz 50 watts max. DC. 20V to 30V at 1.5 Amps. Battery Pack (optional) 3 hours per recharge. Battery charger incorporated in standard instrument. Recharging from AC or 32V DC.
Low Voltage Indicator:	When voltage, powering oscilloscope (AC, DC or battery), falls below correct operating level, the front panel indicator changes from a steady state to a flashing indicator.
Environmental:	Specification is met within power supply range shown and from +5°C to +35°C to 80% RH unless otherwise stated, add 2% to specification for 0—50°C and 0 to 90% RH. Storage:—20°C to +70°C.
Finish:	Instrument contained in a vinyl covered cabinet with offwhite panels.
Dimensions:	175mm high x 345mm wide x 470mm deep overall. Height increases to 230mm with battery pack added.
Weight:	Nett: Instrument 9.3kg. Battery Pack 6.3kg Packed: Instrument 12.5kg. Battery Pack 8kg.
Accessories Supplied:	1:1 and 10:1 Duo Head Miniature Probe, Type P32 (2 off) Instruction Manual.
Options:	Battery Pack /BP3 P7 Phosphor (Long persistence) /04
Optional Accessories:	DC—200MHz 10:1 probe kit P33 DC—300MHz Demodulator Probe kit P34 Viewing Hood H46 Dust Cover C27 Front Panel protective cover SC52 Carrying Case. C100 Oscilloscope trolley T61 Cameras — Details on request. External graticule for video applications.
Battery Pack:	The type BP 3 pack is readily attached or detached from model bwd 540. It is fixed by two screws and connects via a plug to the rear panel socket. If desired the battery pack can be carried separately to the oscilloscope and is provided with a handle for this use. Recharge time of 14 hours provides approx. 3 hours running time.

With a policy of continuous development, variations in technical detail may occur.

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